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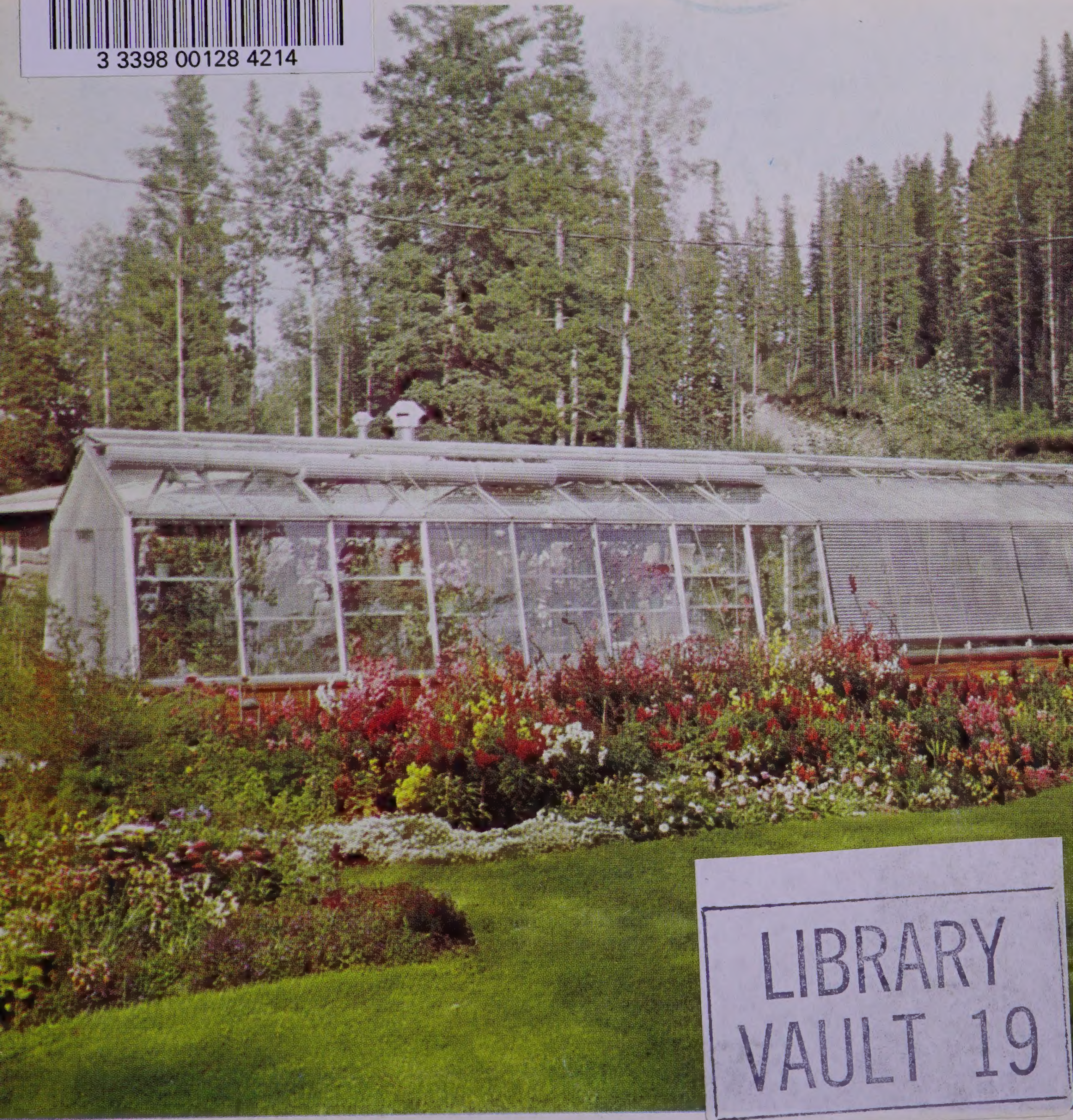
HOTBEDS,

COLD FRAMES & SMALL GREENHOUSES



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HOTBEDS, COLD FRAMES, and SMALL GREENHOUSES

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Certain vegetables and most annual bedding plants in Alberta are started in special plant growing structures and are later transplanted to the field or garden. By starting them several weeks before weather permits outdoor planting, it is possible to mature cool-season plants before the heat of the summer, and to mature long-season, tender crops, such as tomatoes, peppers, eggplants, and celery before fall frosts occur. Earlier maturity enables vegetable growers to take advantage of the early market, while home gardeners are assured of earlier bloom of annual flowers, as well as early vegetables.

Structures used for starting plants include greenhouses, hotbeds, and cold frames. Conventional glass greenhouses provide better ventilation, more working space and more convenience than hotbeds, but are more expensive to construct, heat, and maintain. Ideally, such greenhouses should be utilized on a year-round basis. Hotbeds, used for three to four months each year, are practical for the grower or gardener who needs a structure only for starting plants. Cold frames are used primarily for "hardening" plants that have been started in greenhouses or hotbeds, before they are set out to the field or garden, and to protect them from light frosts.

HOTBEDS

Location

In selecting a site for a hotbed, the following points should be considered:— (1) protection from cold northerly and strong prevailing winds; (2) the site in relation to the water supply; and (3) the nearness to the regular work area. The preferred location should have a southerly exposure to provide a maximum of sunlight for the growing plants. When more than one hotbed is used, the beds should be arranged in a line or parallel to one another, allowing sufficient space for handling sashes.

Construction

(a) The Frame

Hotbed frames are commonly made of wood but permanent installation can be made of concrete blocks. For wooden frames, sturdy posts are driven into the ground at the corners and at intervals along the length of a shallow pit. Planking or two layers of 1-inch boards are nailed to the posts. The back of the frame (usually the north side) is made at least 6 inches higher than the front to shed water and to provide the greatest amount of illumination. Crossbars, from front to back, are set at intervals of 3 feet to support the edges of each sash. A narrow strip (½" x ½") is usually fastened to the center of the crossbar to separate the sashes. A basic unit in construction of a hotbed is 6 feet square (36 square feet) to accommodate two standard sashes (3 feet x 6 feet).

Concrete or concrete block construction is more durable and probably cheaper than lumber in the long run. Similar procedures in construction apply but a more substantial foundation is required.

(b) Sash

Standard hotbed sash can be obtained from dealers in green house supplies. However, many gardeners prefer to use household storm sash, but this would necessitate some adjustment in frame dimensions. Sash of both types have glass lights, are fairly expensive, and are heavy to handle. Plastics offer a solution to many sash problems, as they are durable, light in weight, and have good light transmitting properties. Polyethylene films, in the 4 and 6 mil thicknesses, have been used successfully although this plastic deteriorates slowly when exposed to sunlight. Some of the newer polyester plastics, such as Mylar, have higher tensile strengths with high light transmission qualities. These plastics provide longer life at somewhat higher cost. A Mylar-covered greenhouse in the Edmonton area has been in use for 7 years without serious deterioration.

(c) The Heating Unit

The heating of hotbeds has been traditionally associated with the heat produced by decomposing horse manure, a method that is inconvenient and unreliable. The use of hot water, hot air, or steam systems represents a high investment in equipment. Electricity offers a simple way of supplying heat and, at the same time, permits reliable temperature control.

An electric heating unit consists of three separate parts:

(1) Heating cable - No. 19 nichrome resistance wire, suitably insulated and enclosed in a flexible metal sheath (usually lead)

(2) A weatherproof thermostat - or a thermostat in a weatherproof case

(3) A transmission line to bring sufficient electrical power to the frame location

Heating cable is available in 60-foot lengths for use in 110-volt circuits and in 120-foot lengths for use in 220-volt circuits. To calculate the number of feet of cable required for any frame size, the following formula may be used:

$$L \times W \times 1.667 = \text{No. of feet of cable}$$

where L = length in feet, W = width in feet, and 1.667 = the number of feet of cable required to heat 1 square foot of frame space. For example, a frame 12 feet long by 6 feet wide would require:

$$12 \times 6 \times 1.667 = 120 \text{ feet of cable}$$

which means, one 120-foot length on 220 volts *or* two 60-foot lengths on 110 volts.

A layer of insulating material (vermiculite or cinders) is placed on the bottom of the frame area before the heating cable is laid. Electric heating cable is looped back and forth at a spacing of approximately 7 inches between loops and 4 to 6 inches from the outside edges of the frame and is then covered with an inch of soil. This is illustrated in Figure 1. If plants are to be grown in beds, as shown in the illustration, a wire mesh divider (½- or ¾-inch hardware cloth) should be used to prevent damage to the heating cable by sharp tools. Four to six inches of soil are used to cover the mesh. If plants are to be grown only in flats, the mesh divider and the top layer of soil may be dispensed with and a wooden framework substituted.

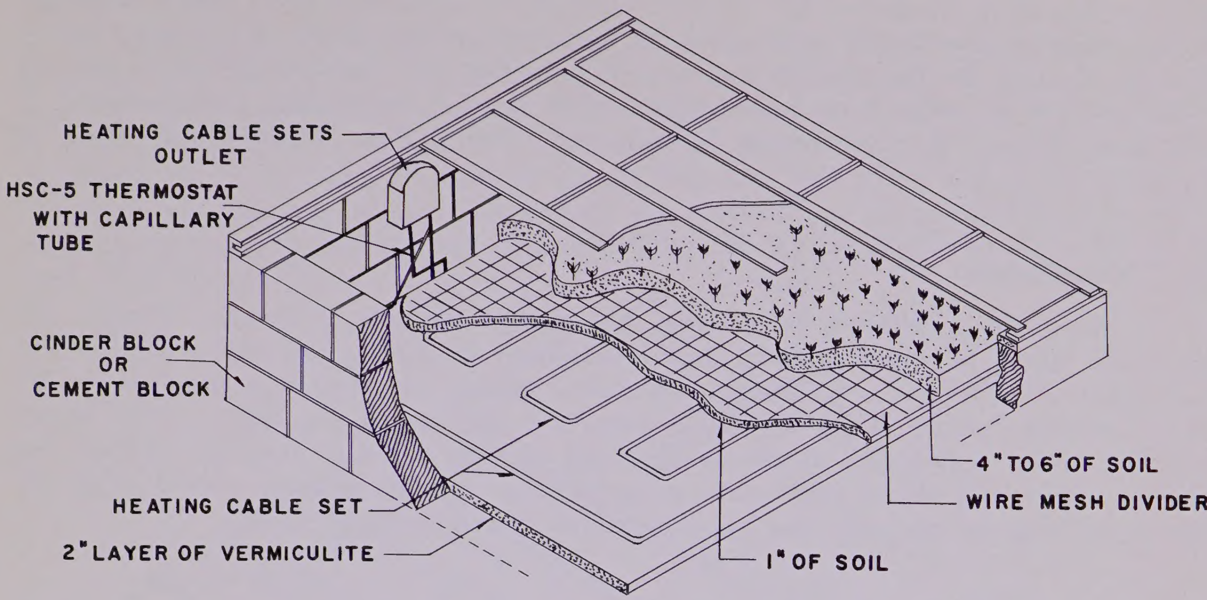

FIGURE I INSTALLATION OF HEATING CABLE IN A HOTBED

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The thermostat consists of a sensing element and a switching unit. The sensing element is usually mounted on 18 inches of flexible capillary tubing and can be used to control soil or air temperatures. One 25-ampere thermostat can be used to control five or six 60-foot or up to three 120-foot lengths of cable. In other words, one thermostat could control the temperature in a hotbed area of up to 216 square feet.

Hotbed Operation

To obtain the maximum benefits from the operation of a hotbed, careful attention must be paid to soil, watering, temperature, ventilation, and protection against weather and disease.

(a) Soil

A good garden compost containing a high proportion of organic matter will give most satisfactory results. If compost is not available, three parts of garden soil (by volume) may be mixed with one part of sand and one part of well-rotted manure or peat moss. Ordinary garden or field soils should not be used alone because they become highly compacted and will restrict root development.

(b) Watering

During early development of seedlings frequent light waterings are more effective than thorough soakings, but as plants develop the intervals between waterings may be extended and the amount of water increased.

(c) Temperature

The temperature requirements of plants vary greatly between species as well as between different growth periods for the same species. For example, tomato and pepper seed will germinate readily at soil temperatures of 70°-75° F., but the temp-

erature should be reduced to 65° F. after emergence to produce good stocky seedlings. Celery, on the other hand, will germinate and develop well at 65° F. Other plants, such as many of the flowering annuals, will do best at soil temperatures of 50°-60° F. Therefore, it is desirable to grow plants with similar temperature requirements in the same frame. If this cannot be arranged, intermediate temperatures must be used.

(d) **Ventilation**

Adequate ventilation is essential for the production of healthy plants. In the early stages of plant growth, brief ventilation by lifting the end or side of a sash every 2 or 3 days is sufficient, but more frequent ventilation is required as the plants become larger. Care should be exercised during sub-freezing, or very windy weather, when ventilation should be arranged so that cold air does not contact the plants. However, slight ventilation even in cold weather reduces condensation on the under side of the sash and permits better transmission of light.

(e) **Extra Protection**

In many parts of Alberta, severely cold weather may prevail during the period when hotbeds are in use. Consequently, provision should be made to have burlap, straw mats, or tarpaulins available for covering the beds to prevent frost injury. Construction of the frame partially below ground level serves as added protection in cold weather.

(f) **"Damping-Off"**

Most of the fungi that cause "damping-off" of seedlings are particularly active under warm, humid conditions when the soil surface is moist. The hazards of this disease may be reduced through adequate ventilation to reduce temperature and humidity and to permit drying of the soil surface. If ventilation must be restricted, the soil surface may be dusted with a good fungicide, such as Captan, to control the casual fungi.

COLD FRAMES

Cold frames can be classified as hotbeds without heat that are used to "harden" plants before they are transplanted to the field or garden. Temperature and watering are reduced, resulting in plants that can be transplanted without loss. The construction is similar to hotbeds, except that cotton covered sash may be substituted for those that are glass or plastic covered. If electrically-heated hotbeds have been used, these may be converted into cold frames by shutting off the electricity and changing the sash.

SMALL GREENHOUSES

Conventional glass greenhouses are expensive to construct and maintain, whereas materials for a semi-permanent, plastic-covered greenhouse can be purchased for less than one-tenth of the cost. Substantial savings in labor costs can also be realized.

Construction

The small greenhouse can be built on a concrete foundation, or attached to posts set into the ground, depending upon the permanence desired. If the plastic is to be attached permanently, standard framing on 16-inch or 24-inch centers should be used and the plastic secured to it by means of light wooden slats. Alternatively, the plastic can be attached to sash-like panels that slide into place and can be removed for storage or displaced slightly to provide for ventilation. If panels are to be used, studding and rafter spacings are determined by the width of the plastic sash to be used (See Figure 2).

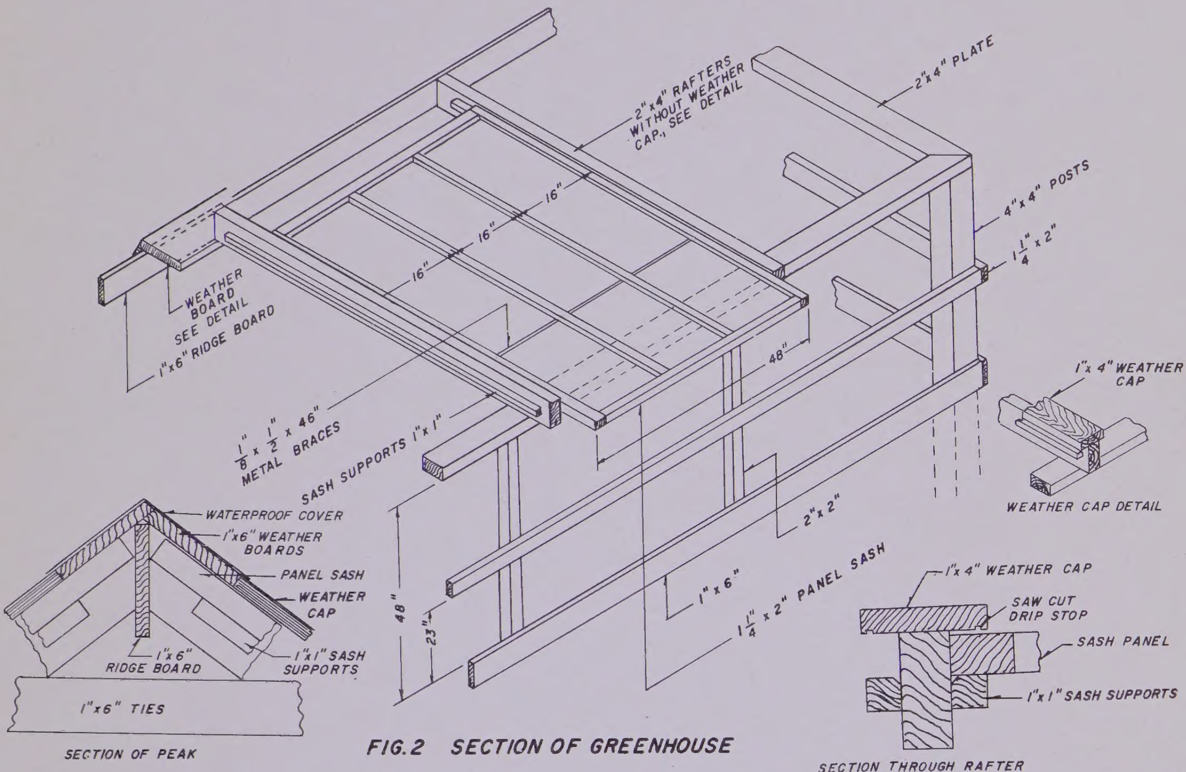

FIG. 2 SECTION OF GREENHOUSE

Glazed hotbed or storm sash may be preferred and similar framing, strengthened to allow for the greater weight of the glass, could be used.

Heating

The most economical means of heating a small greenhouse is by using a space heater of suitable size and providing a fan for air circulation. Hot water, steam, or forced-air heat can be used but would be more practical for larger units because of higher initial costs. If it can be arranged, a reliable thermostat should be used to control the temperature at the desired level. Heating cable, as described for hotbeds, can be used for supplementary heating of greenhouse beds.

Greenhouse Operation

The basic considerations of soil, watering, temperature, and ventilation, as outlined for hotbeds, are essentially the same for greenhouses except that closer attention must be paid to moisture as the larger space encourages greater water use. Extra protection should not be required if adequate heating is provided.

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